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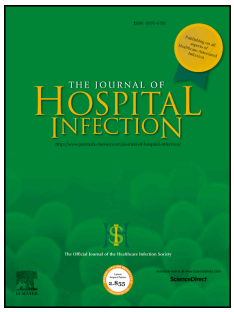

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Is Malnutrition Associated with Orthopedic Infections: a Single-Center Pilot Evaluation

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***Keywords**: malnutrition; orthopedic surgery; association: infections*

Running title: Malnutrition and orthopedic infections

Sir,

Malnutrition is frequent among adult surgical patients [1-3]. Some authors suggest that malnutrition may be an independent risk factor for orthopedic infections. There are, however, few strong original data addressing this issue. We thus performed a prospective pilot quality evaluation for patients at risk of surgical site (SSI) or community-acquired orthopaedic infections. During February 2017-March 2017, we prospectively surveyed the nutritional status of 23 infected (nosocomial and community-acquired infections) and 18 uninfected patients, consecutively hospitalized in our orthopaedic Service. To estimate the presence of malnutrition, we used nine different clinical and laboratory parameters such as the Mini Nutritional Assessment Tool (MNA®) of the Nestlé Nutrition Institute [4], the body mass index, weight, history of weight loss in the last three months, presence of gastrointestinal diseases or diabetes mellitus, serum albumin levels, serum total protein and the serum pre-albumin levels at admission [1,2]. Additionally, we observed if the patient finished his/her meals during hospitalization. As a main result, we found no single difference between those with and without infections in any of these nine standard nutritional parameters (Table 1).

We cannot fully explain this complete absence of difference. Many colleagues think that there is a strong scientific link between malnutrition and SSI. The mechanism by which malnutrition would increase the risk for SSI equally remains obscure. In reality, available scientific literature is scant and national and international guidelines attribute a very low quality of evidence for this association. For example, the CDC guidelines of 1999 remain vague [5]. The recent global WHO guidelines [6] state that "*The panel suggests considering*

the administration of oral or enteral multiple nutrient-enhanced nutritional formulas for the purpose of preventing SSI in underweight patients [only] who undergo major surgical operations", taxing the strength of their own recommendations as "*conditional*" and the quality of evidence as "*very low*".

It might be that the value of the current diagnostic schema for malnutrition may lie essentially in identifying sicker patients. To cite a frequent example, most author groups use hypoalbuminemia with a cut-off of 3.5 g/dL [1,7,8] as the most important marker for malnutrition. However, although albumin may be a reliable serum marker of chronic nutritional status, it is not specific, in that inflammation or stress may also cause hypoalbuminemia without associated malnutrition [1]. Likewise, malnutrition is a confusing and complex term. It includes phenomena related to starvation, includes patients who are overweight as well as those with low nutritional intake. While obesity is a clear risk factor for SSI [1], other aspects of malnutrition might not be.

Our study has three important limitations. Without doubt, the sample size would be too small compared to a randomized trial or a case-control study. Indeed, our study cannot address interventional issues and it is unlikely to be valuable as a platform from which to launch a full study of the topic. In contrast, this study was a prospective pilot evaluation in preparation of a possible interventional trial by searching the best parameters to influence in such a possible future trial. Secondly, in our evaluation, even if we compared nine different parameters, we omitted other literature markers such as total lymphocyte count, serum zinc levels, iron/transferrin, pyridoxin and vitamin-D levels, lymphocyte/monocyte ratios, the measurement of healing time, or anthropometric measurements such as calf and arm

muscle circumference or triceps skinfolds (which all are not routinely assessed on admission). These are all markers of both, malnutrition and SSI, alike. In future trials, we would also need to consider not only gross protein and carbohydrate intake but also (and perhaps especially) micronutrients [1,8]; and perhaps to concentrate on nutritional status independently of confounders such as diabetes and high alcohol intake, gastrointestinal disease and immune-suppression. Accepting that these are important, any proposed trial to determine whether preoperative nutritional optimization might be more feasible without their inclusion. Finally, a literature bias in favor of positive associations is not entirely excluded. Negative results might be less prone for publication. Our pilot study is such a negative evaluation.

Ethical approval

Due to its small sample size, the non-invasiveness, and the use of already sampled parameters at admission, our quality evaluation was waived from formal written consent.

Conflict of interest statement

All other authors declare no conflicts of interest.

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Table 1. Comparing patients with and without infections with emphasis on nutritional parameters

	Infection		**No infection**
n = 41	**n = 23**	***p* value***	**n = 18**
Female sex	12 (52%)	0.89	9 (50%)
Median age	74 years	0.49	74.5 years
Immune suppression	7 (30%)	0.57	7 (39%)
- Diabetes mellitus	7 (30%)	0.84	6 (33%)
Elective surgery	2 (9%)	0.22	4 (22%)
Weight (median)	80 kg	0.13	72 kg
- weight loss in the last 3 months (median)	3 kg	0.21	0 kg
Body mass index (median)	28.9 kg/mm^2	0.45	24.3 kg/mm^2
Gastrointestinal disease	3 (13%)	0.85	2 (11%)
Serum albumin (median)	32 g/L	0.11	33 g/L
Serum pre-albumin (median)	170 g/L	0.89	174 g/L
Serum proteins (median)	65 g/L	0.31	63 g/L
Finishes meal*	100%	0.47	100%
MNA questionnaire (median)°	9 points	0.79	9 points

* Percentage of meal finished according to the (auxiliary) nurses

Pearson-χ^2 and Wilcoxon-ranksum-tests, as appropriate

° Mini Nutritional Assessment[4]